SAE Aerospace
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AEROSPACE STANDARD

SAE AS22227
Issued 2004-02

Bearing, Ball, Annular, Generator and Motor-Generator

This Specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE:

1.1 Scope:

This specification establishes the requirements for antifriction ball bearings primarily intended for use in aircraft electrical generators and motor-generators.

1.2 Classification:

Bearings shall be of the following types:

Type I Bearing, Ball, Annular primarily for aircraft motor generators. (MS17107).

Type II Bearing, Ball, Annular primarily for aircraft generators. (MS17108).

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2. APPLICABLE DOCUMENTS:

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Military

MIL-B-197	Preservation, Packaging and Packing of Antifriction Bearings, Associated Parts, and Sub-Assemblies.
MIL-B-1083	Balls, Bearings, Alloy Steel.

STANDARDS

Federal

FED-STD-66	Steel: Chemical Composition and Hardenability

Military

MIL-STD-105	Sampling Procedures and Tables for inspections by Attributes.
MIL-STD-130	Identification Marking of U. S. Military Property.
MIL-STD-831	Test Reports, Preparation Of
MS17107	Bearing, Ball, Annular, Primarily for Aircraft Motor Generators, Type I.
MS17108	Bearing, Ball, Annular, Primarily for Aircraft Generators, Type II.

(Copies of specifications, standards, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other Publications:

The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

American National Standards Institute (ANSI)

ANSIB46.1-1962 Surface Roughness, Waviness and Lay.

ANSIB3.4-1971 Gaging Practices for Ball and Roller Bearings.

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

3. REQUIREMENTS:

3.1 Qualification:

The bearings furnished under this specification shall be a product which has been tested and passed the qualification test specified herein, and has been listed on or approved for listing on the applicable qualified products list.

3.2 Materials:

3.2.1 Chrome alloy steel: The standard material for the manufacture of balls and rings shall be chrome alloy steel AISI 52100.

3.2.2 Corrosion resistant steel: When specified, the optional material for the manufacture of balls and rings shall be corrosion resistant steel AISI 440C and the material for the manufacture of the retainer shall also be corrosion resistant steel.

3.2.3 Grade steel: The steel shall be of high grade material which will produce finished articles capable of meeting the requirements and tests specified herein. The steel shall be homogeneous in structure, free from cracks, pipes, seams, laminations, surface decarburization, excessive inclusion of nonmetallic impurities and other defects which may render it unsuitable for the intended purpose. On microscopic examinations, the metal shall show a fine grain size, not larger than size 6, and shall be free from signs of overheating.

3.3 Design and construction:

The bearings shall be of such design and construction as to meet the requirements specified herein and on the applicable MS Standards.

3.3.1 Rings: The rings shall be of single piece, deep groove, single row construction without leading grooves and of electric motor quality ---- honed raceways, smooth and quiet running.

3.3.2 Balls: The balls shall meet the requirements of Specification MIL-B-1083, grade 10.

3.3.3 Seals: Two removable and replaceable seals shall be included to prevent loss of lubricant from and entrance of contaminants into the bearing. Seals shall not be adversely affected by the lubricant. The seals shall be so constructed as not to limit the proper functioning of the bearing to which they are fitted. Seals made of standard material, Nitrile (Buna N), shall operate satisfactorily at temperatures of -65° to 250° F without embrittlement, warpage, or loss of lubricant. When specified, seals made of optional material, fluoroelastomer (Viten), shall operate satisfactorily at temperatures of -65° to 400° F without embrittlement, warpage, or loss of lubricant. When specified, no seals shall be included for open-bearing oil flow-lubricated application.

3.3.4 Retainers: Retainers shall retain the balls within the bearings and shall space them circumferentially between the races. They shall be so constructed as not to limit the proper functioning of the bearing to which they are fitted. Retainers shall be of a ball centered design. The retainers shall be formed either with pockets substantially fitting the surface of the balls or with cylindrical type ball pockets, but shall be of such design that the lubricant will be freely admitted. The retainers shall be of materials, workmanship, and finish suitable for the purpose intended. They shall run concentrically with the races. No part of the retainer shall exhibit cracks, burrs, deformities, nor looseness. They shall not run eccentrically visible to the normal unaided eye. Retainers shall be two piece ribbon type, welded or riveted construction.

3.3.5 Dimensions and tolerances: Dimensions and tolerances shall be as specified on the applicable MS Standard. Tolerances shall be ABEC 3 modified (+0.0000"/-0.0002" for bore and outer diameter).

3.3.6 Hardness: The bearing rings shall be hardened to 58-61 Rockwell "C". Ball hardness shall be in accordance with MIL-B-1083 (see 3.3.2).

3.3.7 Corners: Minimum bearing corner shall clear maximum shaft or housing fillet radii as specified on the applicable MS Standards. The corner height measured on the face of bearing rings shall not exceed the values specified on the applicable MS Standards.

3.3.8 Stabilization: Bearings rings and balls shall be dimensionally stable for operation from -67°F to 385°F.

3.3.9 Radial internal clearance: The standard radial internal clearance shall be 0.0007" to 0.0011" loose. When specified, the optional radial internal clearance shall be 0.0004" to 0.0008" standard or 0.0011" to 0.0016" extra loose.

3.3.10 Radial runout: The radial runout of the inner and outer rings shall be as specified on the applicable MS Standard.

3.3.11 Finish: Running surfaces of the races shall be ground or honed to a surface finish of 5 microinches maximum in accordance with ANSIB46.1-1962. The bore, outside diameter, and face shall have a surface finish of 32 microinches maximum. The surface shall be free from tools marks, chatter waves, grinding scratches, soft spots, and other surface defects.

3.4 Interchangeability:

All bearings having the same MS parts number shall be directly and completely interchangeable with each other in respect to installation and performance.

3.5 Lubrication:

The bearings shall have a standard fill of 30 to 40% of void with MIL-G-81322 grease, uniformly distributed within the bearing. When specified, the bearing shall be coated with MIL-C-11796 Class 3 preservation which shall be cleaned and lubricated with MIL-L-7808 or MIL-L-23699 oil prior to use for open-bearing oil-flow-lubricated applications.

3.6 Identification of product:

The bearings shall be permanently and legibly marked for identification in accordance with MIL-STD-130. The identification data applied to the bearings shall be as follows:

a. Mfr's name or trade mark.

b. U.S.

c. Heat stabilization (375° to 385°F) mark permanently marked on either face.

3.7 Workmanship:

The workmanship shall be in accordance with commercial practice used in the manufacture of high grade bearings used in aircraft and similar critical applications. Bearings shall be free from tool marks, chatter waves, rust, grinding scratches, pits, or any other defects that may adversely affect its serviceability.

4. QUALITY ASSURANCE PROVISION:

4.1 Responsibility for inspection:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Test records: The manufacturer shall maintain a record showing quantitative results of all tests performed to the requirements of this specification. The record shall be available to the purchaser and shall be signed by an authorized representative of the manufacturer or the testing laboratory, as applicable.

4.2 Classification of inspections:

The inspection and testing of the bearings shall be classified as follows:

a. Qualification inspection (4.3)

b. Quality conformance inspection (4.4).

4.3 Qualification tests:

4.3.1 Test reports: The contractor shall prepare a test report in accordance with MIL-STD-831 and furnish 3 complete copies of the report to the procuring activity (see 6.2). The report shall be accompanied by a dated drawing which shall describe in detail the manufacturer's product by specifying all dimensions and tolerances, material selected, lubricant, plating, and heat treatment.

4.3.2 Tests: The qualification tests shall include all of the examinations and tests specified under 4.5.

4.3.3 Qualification test samples: Ten samples of each MS part number for which qualification is desired shall be submitted. Drawings containing complete dimensions, construction, materials, heat treatment, finish, and lubricant identification number and date of latest revision shall be furnished for each MS part number submitted.

4.4 Quality conformance tests:

The quality conformance tests shall consist of sampling tests specified in 4.4.3 on each lot of bearings.

4.4.1 Lot: A lot shall consist of bearings of one type and size offered for delivery at one time.

4.4.2 Sample for quality conformance inspection: A random sample of bearings shall be selected in accordance with MIL-STD-105, inspection Level II.

4.4.3 Inspection for reliability provisions: Samples, as specified in 4.4.2 shall be examined for the following:

a. Examination of products (see 4.5.1)

b. Dimensions and tolerances (see 4.5.1)

c. Packaging (see 4.5.9)

In addition, laboratory verification of all other tests shall be performed on random samples from periodic lots as specified by the procuring activity (see 6.2) to determine continued performance with the requirements of this specification.

4.5 Test methods:

4.5.1 Examination of product: Each sample bearing shall be inspected for conformance to this specification and the applicable MS Standard with regard to workmanship, dimensions, tolerances, finish, identification and lubrication. Nonconformance to applicable paragraphs of this specification and MS Standard shall be cause for rejection. Dimensional measurements shall be in accordance with ANSI B3.4-1971.

4.5.2 Hardness: All sample bearings of each MS size shall be tested for inner and outer ring hardness. One shall be disassembled and tested for hardness of the rolling contact area of the inner ring, outer ring, and one ball, using any standard means for hardness testing. Hardness shall be as specified in 3.3.6 for rings.

4.5.3 Surface finish: Surface roughness shall be measured in accordance with ANSIB46.1-1962. A test shall be made on the bearing disassembled for 4.5.2.

4.5.4 Seals: Bearings with seals installed shall be subjected to temperatures of -67°F to 325°F for 100 hours at each temperature. Seals showing nonretention of lubricant, deterioration, or embrittlement due to temperature shall be considered to have failed.

4.5.5 Dimensional stability: The bearing shall be held at 375° ± 20°F for 300 hours. Bearings that show a dimensional change of more than 0.0001 inch per inch of diameter shall be considered to have failed. The bearings shall then be cold soaked at -67°F ± 10°F for 300 hours and then measured. Measurements shall be made at room temperature. Bearings that show a dimensional change of more than 0.0001 inch per inch of diameter shall be considered to have failed.